

affecting the data payload in order to achieve low-latency packet forwarding and routing. Second, there is the challenge of involving as little electronic processing as possible. Subcarrier multiplexed (SCM) header techniques meet both these requirements by allowing relatively easy separation of the subcarrier header from the baseband data payload compared to conventional time domain header techniques.

REMARKS

Claims 1-13 are pending in the application. Claims 1-3 and 6-8 as well as claims 4-5, 9 and 10, stand rejected under 35 U.S.C. 103(a) as being unpatentable over Donald (U.S. Pat. No. 6,415,074 in view of Chang (U.S. Pat. No. 6,160,651) and Jones (U.S. Patent No. 6,281,998). Additionally, claims 11-13 stand rejected as above and additionally over Sasayama and Gehler. Without prejudice to any other remedies available, the Applicant respectfully traverses all of the rejections on grounds that the present invention is nonobvious in light of the cited and applied references. The following arguments apply to all claims.

Referring to claims 1 (method) and 6 (device), the Examiner has paraphrased language from those claims and attempted to relate the claim language to the applied references. Evidently, the Examiner equated the use by Donald of optical circulators 12 to the optical circulator in Figure 1 of the present application. However, the Applicant contends that Donald employs and teaches use of mechanisms that differ substantially from those of the claimed invention and that the mechanisms employed are for completely different applications than those to which the present claims are directed.

A distinction must be recognized between subcarrier multiplexing with optical filtering of a subcarrier multiplexed signal and the very different type of filtering discussed in Donald. Donald's patent is about a reconfigurable add-drop function of optical wavelength channels. Such channels are for data and lack any relation to control functions. Subcarrier based labels or headers are simply not a part of Donald's teaching and cannot be extrapolated from an obvious extension of his teachings.

In Donald, there is no teaching about header or label separation. Moreover, an IP network wherein IP protocol headers are usually subcarriers is not even remotely suggested by Donald. Chang's teachings fail to supply the noted deficiencies in any case. Chang has been cited for subcarrier extraction. Jones has been cited for showing use of a Bragg grating for frequency separation. Both references derive their relevance only from a reading of the Specification for the present invention and still fall short.

The present invention claims optical filtering used to separate *subcarrier multiplexed optical headers*. This is completely different from Donald's teaching, which teaches use of an optical filter to sort out optical wavelength channels, i.e., channels at the frequencies at or close to that of light. This mechanism has been known for many years. AS noted below, it does not suggest or employ baseband optical techniques.

In the past, optical-to-electrical conversion has been required to separate a subcarrier riding on a carrier, followed by electrical frequency-domain filtering to discard artifacts.

On the other hand, *optical filtering* of an *optical subcarrier* is not obvious. The present method contemplates all-optical extraction without involving electronics.

It is important to understand that this is not an obvious extension of Donald's teaching. Mathematically, *subcarrier* filtering in the *optical domain* achieves separation of the *optical carrier band* from the *optical subcarrier band*. Mathematically, the separated optical subcarrier can utilize a simple baseband detector to demodulate the header. This is done totally optically. The processing is very different from either electronic subcarrier separation technique or wavelength separation techniques. This distinction is evident from a reading of the present Specification.

The Applicant can only conclude that the references were applied based on a hindsight reconstruction of the present invention from the teachings of the present specification. It is therefore respectfully submitted that all claims 1-13 properly define allowable subject matter.

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CONCLUSION

In view of the foregoing, Applicants believe all claims now pending in this Application are in condition for allowance. The issuance of a formal Notice of Allowance at an early date is respectfully requested.

If the Examiner believes a telephone conference would expedite prosecution of this application, please telephone the undersigned at 650-326-2400.

Respectfully submitted,



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VERSION WITH MARKINGS TO SHOW CHANGES MADE

IN THE SPECIFICATION:

On page 1, line 25, paragraph 04, after "First" insert --,--. On page 1, line 31, paragraph 04, delete "of the" second occurrence.

[04] While the integration of data networking and optical networking is a key to the next generation optical Internet, all-optical signal processing techniques involving optical headers are still premature for practical system applications. All-optical signal routing control has been suggested through the technique of Optical Label switching. Optical Label switching incorporates a short optical label at wavelengths adjacent a data signal wavelength, the label containing routing information in its modulation. There are two key challenges in implementing Optical-Label switching systems and routers. First, there is a stringent requirement for viable optical header processing and optical switching technologies, specifically, optical label switching networks will require a simple and effective method to swap headers in real time without affecting the data payload in order to achieve low-latency packet forwarding and routing. Second, there is the challenge of involving as little electronic processing as possible. Subcarrier multiplexed (SCM) header techniques meet both these requirements by allowing relatively easy separation of the [of the] subcarrier header from the baseband data payload compared to conventional time domain header techniques.

IN THE CLAIMS (NO CHANGES):

The following claims are reproduced for the convenience of the Examiner.
There have been no amendments:

1. A method for extracting information in an optical subcarrier of a subcarrier multiplexed baseband optical signal, the subcarrier multiplexed baseband optical signal comprising a modulated optical carrier for a payload and a modulated optical subcarrier for control information, the modulated optical subcarrier being at a

subcarrier frequency which is separated from the modulation bandwidth of the optical carrier, the method comprising:

receiving the subcarrier multiplexed baseband optical signal at an input port of an optical circulator;

applying the subcarrier multiplexed baseband optical signal via an extraction port of the optical circulator to a fiber Bragg grating;

optically separating the modulated optical subcarrier in the fiber Bragg grating and directing the modulated optical subcarrier to an optical energy transducer while reflecting the modulated optical carrier back to the extraction port of the optical circulator; and

outputting the modulated optical carrier to an output port of the optical circulator.

2. The method according to claim 1 further comprising:
outputting a modulated electrical signal from the optical transducer which is proportional to modulation of the modulated optical signal; and
detecting the information modulating the electrical signal.

3. A method for swapping control information of a subcarrier multiplexed baseband optical signal, the subcarrier multiplexed baseband optical signal comprising a modulated optical carrier for a payload and a modulated optical subcarrier for control information, the modulated optical subcarrier being at a subcarrier frequency which is separated from the modulation bandwidth of the optical carrier, the method comprising:

separating the modulated optical carrier from the modulated optical subcarrier according to the method of claim 1; and

applying the modulated optical carrier to an optical modulator adapted for writing new subcarrier modulated control information.

4. A method for controlling the propagation path of a subcarrier multiplexed baseband optical signal comprising a modulated optical carrier for a payload and a modulated optical subcarrier for control information, the modulated optical subcarrier being at a subcarrier frequency which is separated from the modulation bandwidth of the optical carrier, the method comprising:

receiving the signal at the input to a routing element;

extracting the modulated optical subcarrier control information according to the method of claim 2;

changing the wavelength of the optical carrier for the payload in response to the control information; and

directing the optical carrier for the payload along one of a plurality of output paths from the routing element responsive to the control information.

5. The method according to claim 4 further comprising the step of modulating the directed optical carrier to add a subcarrier containing new control information.

6. A device for extracting information in an optical subcarrier of a subcarrier multiplexed baseband optical signal, the subcarrier multiplexed baseband optical signal comprising a modulated optical carrier for a payload and a modulated optical subcarrier for control information, the modulated optical subcarrier being at a subcarrier frequency which is separated from the modulation bandwidth of the optical carrier, the device comprising:

an optical circulator having an input port for receiving the subcarrier multiplexed baseband optical signal, a bi-directional extraction port and an output port;

a fiber Bragg grating optically coupled to said extraction port of said optical circulator for optically separating the modulated optical subcarrier from the subcarrier multiplexed baseband optical signal and reflecting the modulated optical carrier to the optical circulator; and

an optical energy transducer optically coupled to receive the modulated optical subcarrier.

7. The device according to claim 3 wherein the optical energy transducer is a photodetector for generating a electrical signal proportional to the signal of the modulated subcarrier and further including:

a detector for detecting the information modulating the electrical signal.

8. A device for swapping control information of a subcarrier multiplexed baseband optical signal, the subcarrier multiplexed baseband optical signal comprising a modulated optical carrier for a payload and a modulated optical subcarrier for control information, the modulated optical subcarrier being at a subcarrier frequency which is separated from the modulation bandwidth of the optical carrier, the device comprising:

an optical subcarrier receiver according to claim 6 and a means for modulating the modulated optical carrier to add new information contained in a new modulated optical subcarrier.

9. An optical routing device adapted for controlling the wavelength and manner of propagation of a subcarrier multiplexed baseband optical signal, said subcarrier multiplexed baseband optical signal comprising a modulated optical carrier for a payload and a modulated optical subcarrier for control information, the modulated optical subcarrier being at a subcarrier frequency which is separated from the modulation bandwidth of the optical carrier, the routing element comprising:

an optical subcarrier receiver according to claim 7;

a controller for controlling other components in response to the control information extracted by said optical subcarrier receiver; and

a tunable optical source coupled to said controller, adapted for emitting an optical signal with a modulation proportional to the modulated optical carrier at a wavelength dictated by the control information on the said control information.

10. The device of claim 9 wherein the tunable optical source comprises:

a tunable laser optically coupled to a semiconductor optical amplifier.

11. The device of claim 9 further comprising a wavelength switch having at least one input and a plurality of outputs, the switch being optically coupled to the tunable optical source and adapted for directing an optical signal on any of its inputs to a specific output in accordance with the wavelength of the input signal.

12. The device of claim 11 wherein the wavelength switch is an array waveguide grating.

13. The device of claim 11 further comprising an array of optical modulators coupled to the outputs of the wavelength switch, said modulators adapted for further modulating the modulated optical carrier signal to add additional information.